

We claim:

1. A computer-implemented method for modeling a data set comprising:

selecting an initial set of hyperparameters for determining a prior distribution for the data set for modeling thereof, the prior distribution approximated by a product of a

5 distribution of the set of hyperparameters, a distribution of a set of weights, and a distribution of a set of predetermined additional parameters; and,

iteratively updating the distribution of the set of weights, the distribution of the set of hyperparameters, and the distribution of the set of predetermined additional parameters until a predetermined convergence criterion has been reached,

10 such that the product of the distribution of the set of hyperparameters, the distribution of the set of weights, and the distribution of the set of predetermined additional parameters as have been iteratively updated approximates the posterior distribution for modeling of the data set.

15 2. The method of claim 1, further comprising initially inputting the data set to be modeled.

3. The method of claim 1, further comprising outputting the posterior distribution as approximated by the product of the distribution of the set of hyperparameters, the set of weights, and the set of predetermined additional parameters.

4. The method of claim 1, wherein the data set comprises a continuous data set, such that the set of predetermined additional parameters comprises a set of parameters accounting for noise.

5. The method of claim 1, wherein the data set comprises a discrete data set, such that
5 the set of predetermined additional parameters comprises a set of parameters accounting for a lower bound.

6. A computer-implemented method comprising:

inputting a data set to be modeled;

determining a relevance vector learning machine via a variational approach to obtain

10 a posterior distribution for the data set; and,

outputting at least the posterior distribution for the data set.

7. The method of claim 6, wherein determining the relevance vector learning machine comprises:

selecting an initial set of hyperparameters for determining the prior distribution for

15 the data set, the prior distribution approximated by a product of a distribution of the set of hyperparameters, a distribution of a set of weights, and a distribution of a set of predetermined additional parameters; and,

iteratively updating the distribution of the set of weights, the distribution of the set of hyperparameters, and the distribution of the set of predetermined additional parameters
20 until a predetermined convergence criterion has been reached.

8. The method of claim 6, wherein the data set comprises a discrete data set, such that the set of predetermined additional parameters comprises a set of parameters accounting for a lower bound.

9. The method of claim 6, wherein the data set comprises a continuous data set, such
5 that the set of predetermined additional parameters comprises a set of parameters accounting for noise.

10. A machine-readable medium having instructions stored thereon for execution by a processor to perform a method for modeling a continuous data set comprising:

10 selecting an initial set of hyperparameters for determining a prior distribution for the continuous data set for modeling thereof, the prior distribution approximated by a product of a distribution of the set of hyperparameters, a distribution of a set of weights, and a distribution of a set of parameters accounting for noise; and,

15 iteratively updating the distribution of the set of weights, the distribution of the set of hyperparameters, and the distribution of the set of parameters accounting for noise until a predetermined convergence criterion has been reached,

such that the product of the distribution of the set of hyperparameters, the distribution of the set of weights, and the distribution of the set of parameters accounting for noise as have been iteratively updated approximates the posterior distribution for modeling of the continuous data set.

20 11. The medium of claim 10, wherein the method further comprises initially inputting the continuous data set to be modeled.

12. The medium of claim 10, wherein the method further comprises further comprising outputting the posterior distribution as approximated by the product of the distribution of the set of hyperparameters, the set of weights, and the set of parameters accounting for noise.

5 13. A machine-readable medium having instructions stored thereon for execution by a processor to perform a method for modeling a discrete data set comprising:

selecting an initial set of hyperparameters for determining a prior distribution for the discrete data set for modeling thereof, the prior distribution approximated by a product of a distribution of the set of hyperparameters, a distribution of a set of weights, and a
10 distribution of a set of parameters accounting for a lower bound; and,

iteratively updating the distribution of the set of weights, the distribution of the set of hyperparameters, and the distribution of the set of parameters accounting for a lower bound until a predetermined convergence criterion has been reached,

such that the product of the distribution of the set of hyperparameters, the distribution
15 of the set of weights, and the distribution of the set of parameters accounting for a lower bound as have been iteratively updated approximates the posterior distribution for modeling of the discrete data set.

14. The medium of claim 10, wherein the method further comprises initially inputting the discrete data set to be modeled.

20 15. The medium of claim 10, wherein the method further comprises further comprising outputting the posterior distribution as approximated by the product of the distribution of

the set of hyperparameters, the set of weights, and the set of parameters accounting for a lower bound.

16. A machine-readable medium having instructions stored thereon for execution by a processor to perform a method comprising:

- 5 inputting a data set to be modeled;
- determining a relevance vector learning machine via a variational approach to obtain a posterior distribution for the data set; and,
- outputting at least the posterior distribution for the data set.

17. The medium of claim 16, wherein determining the relevance vector learning machine
10 comprises:

 selecting an initial set of hyperparameters for determining the prior distribution for the data set, the prior distribution approximated by a product of a distribution of the set of hyperparameters, a distribution of a set of weights, and a distribution of a set of predetermined additional parameters; and,

- 15 iteratively updating the distribution of the set of weights, the distribution of the set of hyperparameters, and the distribution of the set of predetermined additional parameters until a predetermined convergence criterion has been reached.

18. The medium of claim 16, wherein the data set comprises a discrete data set, such that
20 the set of predetermined additional parameters comprises a set of parameters accounting for a lower bound.

- that the set of predetermined additional parameters comprises a set of parameters accounting for noise.

accounting for noise.

[illegible]